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SOME SALIENT FEATURES IN FARM ORGANIZATION.[1]

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In our discussion of some of the salient features in farm organization we should, no doubt, find it profitable to make a careful examination of the question, from the standpoint of both the financial and physical organization of the farm. Both of these phases of farm organization are of primary importance, and no study of the question would be complete without paying considerable attention to the problems involved under these two heads. Because of the limited time at my disposal, however, and because of the fact that these phases of the problem are perhaps better understood than others which I hope to discuss more in detail I shall only touch upon a few of the most important considerations in the financial and physical organization of a farming business.

In the financial organization of a farm we are concerned mainly with the size of the business which is best adapted to the particular type of farming under consideration, and with the most advantageous distribution of the investment in the various items of farm property.

While we have not as yet determined with any high degree of accuracy the *best* size of business for the principal types of farming, we have determined within reasonably narrow limits the *minimum* size which is fairly well adapted to the successful operation of farms carrying on the principal types of farming in the different type areas. Thus we find that in nearly all of the areas studied the minimum size of farm which seems to be well adapted to the prevailing type of farming is one which is large enough to provide full employment for approximately two men. In the middle west, insofar as is shown by the data available, this means that the minimum size for successful farms ranges from 80 to 100 acres of crop for dairy farms; from 120 to 140 acres of crop for mixed farms on which the major part of the crops grown is fed to meat-producing animals; and from 150 to 180 acres of crop for grain farms on which most of the crops grown are sold directly. Naturally the *acreage of crops raised,* will be a better measure of the size of farm than the *total* acres, since any areas in timber or permanent pasture usually require only negligible amounts of labor. It is, of course, true that the size of farm may sometimes be measured in terms of capital invested, or on the basis of the amount of labor used, but in general farming the *acres of crop* grown is perhaps the most satisfactory single measure of the size of farms.

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Insofar as the investigations made to date throw any light upon the question of the *most profitable* size farm, it would seem that the most successful farms in the middle west are those which are 50 percent or more above the average in size, *i.e.*, farms which have a large enough business to provide employment for three or more instead of the minimum of two men.

In the study of the most advantageous distribution of the investment in the various items of farm property, we must naturally take into consideration the question of the amount of capital available to the operator. This will decide in a large measure whether he will own his own farm or rent land from another, using his capital to invest in horses, machinery, livestock, and other items of personal property. The man with limited capital and a fair amount of managing ability will unsually do better to rent a part or all of his land in order to have a business large enough to offer opportunity for the full utilization of his management skill. It is generally better for the capable farmer to be a tenant on a farm large enough, than to own a small farm on which he would be handicapped by lack of land or capital in carrying on the business in the most effective manner.

The investment in farm buildings, machinery and work animals necessary to satisfactorily meet the shelter requirements and to perform the farm work in an efficient and economical manner have been fairly well worked out for nearly all of the principal types of farming in the older agricultural regions.

The investment in the various classes of livestock and the amount to be invested in fertilizing materials to replace the plant food removed from the farm in the system of production employed will be considered in the discussion of the production of the crop and animal enterprises.

Before taking up in detail the discussion of the productive organization of the farm, I wish only to point out in passing that the question of the physical organization of the farm as a whole as well as the organization of the farmstead and the farm buildings, presents many problems of primary importance. The proper organization of the field system is necessary to best meet the needs of the cropping system planned; to economize on fencing and man and horse labor used in performing the field work; to save time in getting from the farmstead to the fields; and to reduce the length of haul in moving fertilizer from the farmstead to the fields and in transferring crop materials from the fields to the farmstead.

The planning of the physical organization of the farmstead, the farm buildings, and the general layout of the farm plant deserves the most careful consideration. This is of special importance from the standpoint of sanitation and comfort, both for the farm family as well as the farm animals, and from the standpoint of convenience in the care and feeding of the livestock carried.

In studying the productive organization of the farm, to which I wish to devote the major portion of my paper, we must appreciate at once that we are dealing with a number of highly complex and interrelated factors all of which have a bearing on the final results of the business. The productive organization of the farm deals with such important problems as the selection of the crops which are to be included in the cropping system and the determining of the proportions in which the various crops selected are to be grown. This problem must be worked out on the basis of the influence of the cropping system on soil maintenance; the relative profitableness of the various crops included in the rotation; the most advantageous utilization of man and horse labor required in growing such crops; the providing of insurance against crop failure and market fluctuations, by including in the rotation crops having different seasonal and climatic requirements; and the adaptation of the crops grown to the livestock which is to be included in the system of production planned.

If the system of farming planned is to include the production of one or more classes of livestock, as it must of necessity in a very large proportion of all farms, we must again decide as to the kind or class of animals which is to be carried, the total amount of all livestock, and the proportion of each class of animals selected. This problem must be worked out mainly on the basis of the feed crop produced under the cropping system adopted; the proportion of the farm which must necessarily remain in woodland and permanent pasture; the marketing factors including the distance to markets, wagon roads, railroad and other means of transportation, and the demand for the different livestock products at the markets available; also upon the character and supply of labor available in the region under consideration.

It is obvious that in attempting to work out all of these problems.

giving due consideration to all of the factors involved, and finally deciding upon the course of procedure to be followed after all of the factors have been carefully considered, that the farmer must have a large background of experience and he must have at his command all of the information bearing on the question if he is to be even reasonably well equipped to plan the productive organization of his farm in such a way as to contribute most to its profit and general success.

Because of the fact that farm organization has been developed so largely on the basis of empirical information, and because we have only recently begun to pay serious attention to the problem of making definite plans for the scientific organization and operation of our farms, it has been somewhat generally assumed that it was not only impracticable but impossible to make any systematic plans for the organization and operation of a farming business. While it is no doubt true that we do not have as yet all of the facts necessary to work out such a problem on a definite engineering basis; we do have, if we will but collect and organize the available information, a very good basis for making a good beginning in working out definite plans for the organization of our farms in practically all of the important farming regions where agriculture has been carried on for a reasonable length of time.

In order to point out somewhat specifically what seem to me to be the essential facts which need to be taken into consideration in planning the organization of a farm and to illustrate how such facts can be used, I wish to discuss somewhat the whole question of making a definite plan for the organization of a farm in any given region, and to what extent the practical farmer shall probably be justified in making such plans.

In discussing the planning of a system of farming, the first question which naturally arises, is, can we plan a system of farming with any measure of assurance that the general results anticipated can be realized even approximately?

Before attempting to answer this question, let us examine somewhat the nature and essential characteristics of types and systems of farming. In doing this let us inquire first into what constitutes a type of farming. We have in each important agricultural region, where agricultural practices have become somewhat thoroughly established, a certain general scheme of production which is typical of a considerable proportion of all farms in that region. These farms follow the same general plan of crop and animal production. They are more or less uniform in size, soil type, topography, buildings, equipment, labor requirements and other essential characteristics of a farm business. These groups of farms we ordinarily designate as types.

These farming types represent the best adjustment which those identified with their development have been able to work out with their present knowledge and ability to cope with the conditions as they actually obtained. They represent a great deal of experience, and a considerable amount of skill in keeping the farming of the region adjusted to the constantly changing economic conditions. It is not to be assumed, however, that these types, necessarily including a large number of farms, represent absolutely the best adjustment that can be made at any given moment. In fact, since the conditions of production, such as price of land, supply and price of labor, cost of buildings and machinery, cost of fertilizers, and a variety of other factors, are continually changing, to say nothing of the changes in demand for different farm products and the resultant difference in their relative profitableness, we may assume that these types which naturally change rather slowly as a general rule are not always, if ever, in the most profitable adjustment. In fact, every advance in methods of production and marketing tends to make obsolete to some extent the present plans. Naturally some farmers will be more acute to the changes required, and will make their plans as adaptable as possible in order to take advantage to the fullest extent of such desirable changes. These will naturally increase their profits over others in proportion as they can keep their business better adapted to the changing conditions.

Entirely aside, however, from the matter of keeping the farm business adjusted to the times, is the question of developing the general efficiency of the business in producing the crops and animals which may be somewhat typical of the region. That is, a farm may be fairly typical of the region in that it produces the same crops and in the same general proportions, and feeds them to the same general classes of livestock. It may be getting considerably better results, however, because it produces larger crops or makes a larger return for these crops when they are fed to livestock. Or if it does not secure larger returns in terms of crops or animals it may be producing equally good returns with a smaller expenditure for man labor, horse labor, machinery use, or other items of expense in operation. That is, the type of farming may be the same, but the system of production may be very much more efficient.

Naturally these differences in the systems of production employed may also include to a greater or less extent important differences in the kind and proportions of crops grown or in the class and proportion of livestock produced. For example, they may include in the rotation a greater amount of legume crops than is common to the region. This in itself represents one of the fundamental differences in systems of farming. It may determine for all practical purposes whether the system is extractive or whether it attempts to maintain the soil. That is, while the growing of legumes in large enough acreage to maintain the nitrogen does not of itself insure the maintenance of the soil, it represents in many sections the initial and often the most difficult step in the introduction of a permanent system. The mineral fertilizers, particularly phosphorus and limestone where these are needed, can usually be purchased in inexpensive form and applied at relatively small cost.

The growing of legumes in greater proportion than is commonly grown in the region, or the production of crops in different proportions might constitute the first step in differentiating the system of production employed from that used on the most typical farms. Whether such variations from the typical are justified from the standpoint of profits is a matter which must be based on a careful analysis of existing conditions. Unless they are better adapted to the conditions obtaining than the usual plan they will not tend to increase the profits of the business.

We might say, then, that any plan of production which is to produce results better than those obtained from the typical farms of the region, must do so either by carrying on the usual type of farming with unusual efficiency, or by deviating from the usual types of production in such ways as will result in increasing the profits in the business. That is, we might say that such systems must employ unusual skill either in following the usual practice, or in anticipating the changes which are justified but which have not as yet come into common practice. On this basis we might define a system of farming as a carefully worked out plan of conducting a farm business in which some systematic effort has been made to employ scientific methods of organization and operation.

The question as to whether we can plan a system of farming with any reasonable assurance that it can be carried out successfully, is one which must rest largely on experience. That is, the question as to whether it can be done, must be answered before long by the facts as to whether anyone is really doing it.

On the basis of considerable observation of actual farmers attempting to carry out somewhat carefully planned systems of farming, and on the basis of general accounting and cost accounting studies made in Illinois and elsewhere, it is not too early to say that significant progress has already been made in planning systems of farming, and in executing the plans made. Naturally we can hardly expect as yet to reduce such plans to a definite engineering basis, although we have already made important advances in determining the best adaptation of different crops, the plant food requirements of crop production, the feed requirements of different classes of animals, the labor requirements of different crop and animal enterprises, and a variety of other factors which will be of great importance in working out much more definite systems of production.

While it is frequently pointed out that farmers cannot control the weather and other factors of almost as great importance, it must be kept in mind that the weather also affects other industries. These are often quite as much at the mercy of the weather as is the farmer. A carefully planned system of production may not eliminate adverse seasonal conditions, but it usually goes a long ways towards modifying the results of such adverse seasons. It may not be able to guarantee maximum yields, in a bad season, but it should go a long ways toward insuring against a total crop failure, and in making the most profitable use of the crops produced, even though yields may be considerably below the normal. A good system of farming is not a "fool proof" guarantee of profits, but a reasonable insurance against loss in an unfavorable year. From this standpoint it deserves the most careful study on the part of the farmers of every agricultural region with a view to working out the best systems for each particular region.

As we get more accurate information regarding the essential facts in our most important agricultural regions we shall have a continually better basis for planning such systems of farming. As we work out and learn to understand more fully the principles underlying various systems of farming and determine the basic factors for certain standard operations we shall have an increasingly better foundation for reducing our systems to a scientific basis. It is interesting to note that the same problems were met with much skepticism and even ridicule in engineering circles 15 or 20 years ago.

In planning a system of farming for any given region we must first take as accurate as possible an inventory of the types of farming already being carried on. We must attempt to analyze as well as we can the basis for deviating from the standard practices or types of the region. That is, we must decide to what extent we may deviate profitably from it. Naturally any important deviations must be made only on the basis of the best possible reasons. We must assume that the present practice had at some time a good reason for existing. The only basis for varying from it would assume that changing conditions justify such changes in the system of production.

One of the first and most important problems to be decided is that of working out a system of production that is designed to maintain the productive capacity of the land itself. It is evident to all students of this problem that the agriculture of every new region must almost of necessity be extractive. This is true because farming has in general been carried on on a very narrow margin of profit, and because those who would have made provision for maintaining their soils had to produce in competition with those who paid no attention to the matter. Since land was cheap and the supply usually almost unlimited, each man could make the largest return by farming a large area, *i.e.*, farming extensively and farming extractively.

The natural fertility of the land and the cropping system practiced determined to a large extent how long such lands could be farmed before the yields declined sufficiently to justify any change in the systems of production. Sometimes a simple expedient was found by merely selling or abandoning the land and moving on to other virgin areas in a new region. It must not be assumed, however, that declining yields are the best basis for deciding when to change from an extractive to a more permanent system of farming. This may be economically justified long before there is any evidence of declining yields. This is especially true on the most fertile soils.

Before such lands actually decline in yields, the price of the land has usually advanced far beyond the original cost. This factor alone may be the basis for deciding upon a more permanent system of production. Under these new conditions, it is usually necessary to make a much larger return per acre if a satisfactory rate of interest is to be made on the investment. In the corn belt for example, due to the unusual fertility of our soils, we have farmed extractively perhaps as long as in any important agricultural region. A great mass of experimental data on the detailed study of soils and crop yields, as well as accounting studies on actual farms, indicate that a more permanent system of farming in this region has been justified economically for some time past. That is, the unit costs of production for the standard farm crops is less under a good system which approximates permanency, than where an extractive system is practiced. In spite of this fact, the general types of farming carried on are still almost entirely extractive.

Entirely aside from the important question of national policy and public welfare involved in the conservation of our soil resources is the question of sound business practice from the standpoint of the individual farmer. If farming is to be considered as a continuous-going business instead of a speculative or real estate enterprise, conservative accounting practice demands that the farmer take into account the depreciation of his chief asset, the land, or that such replacements as are necessary to maintain the land be included as a part of his costs of production. This must be done even though the land itself may be advancing in price, in spite of the fact that it is generally declining in productive capacity. It is of first importance that farmers generally establish permanent systems of production, or at least go as far in that direction as the economic conditions warrant. From all of the data available it is plain that for practically all of our older agricultural regions, such systems are not only imperative from the standpoint of national policy, but more profitable from the standpoint of the individual operator.

In planning the system of crop and animal production for an individual farm the following outline giving the detailed steps in the process and the order in which they would perhaps logically be taken up may serve as a general guide in establishing principles of procedure.

If the farm under consideration is typical of the region as to size, proportion of land improved, soil type, and other general factors we may assume the system of farming planned had best follow the general practice of the region. This is especially true while the plan is getting into operation, leaving any marked variations to be worked out somewhat gradually on the basis of experience as shown not only by general observations but also by carefully kept records and accounts of the results of the business.

Insofar as the factors of soil and topography are typical of the region they will decide quite definitely the kind of crops which must be grown in any area where the agriculture is fairly well established. I wish to emphasize this point particularly. We are prone to speak of the choice of enterprises with reference to crops as well as livestock as though the farmers of every region had a wide range of choice and that the problem of selecting a few crops from a list embracing a considerable number was one of the important decisions which the farmer has to make in organizing his system of production.

As a matter of fact this is not true to any great extent in any important agricultural region with which I am familiar. The natural factors such as climate, soil, and topography determine within very narrow limits what crops can be grown economically in a region. In most areas this list is confined to not over three or four non-legume crops. The list of legumes is scarcely as large, embracing usually not more than two or three. In any event the relative profitableness of the various crops which can be grown in a region differs to such an extent as to narrow the choice down to a very few crops, even when we take into consideration the most advantageous distribution of labor and the factor of insurance made possible by a reasonable diversity of crop production.

If we examine a few of the most important farming areas with reference to this point we note that very few of them are growing more than two or three non-legumes as major crops. Most of these areas are growing not more than one or two legumes. In the Northwest for example, spring wheat is the principal crop. Barley and oats are the other two important non-legumes. Legume crops are grown only in a limited way in most of this area, with red clover exceeding by far all other legumes combined. In the corn belt, corn is the principal crop. Oats, and fall wheat in some sections, make up a very large part of the non-legume area in addition to corn. Red clover is by far the most important legume crop, although alfalfa, other clovers, and soy-beans make up an appreciable proportion of the legume acreage. In the South, cotton is the chief crop. Corn, a direct competitor of cotton, and oats are the most important other non-legume crops. The cow pea and crimson clover are the more important legume crops grown. In New England, timothy hay, oats and potatoes are the most important non-legume crops. Red clover and alfalfa are the principal legumes grown.

In nearly every one of these areas there is one outstandingly important non-legume crop from the standpoint of profitableness. Because of this factor it has been the common practice of nearly every one of these regions to grow the one most profitable crop more or less to the exclusion of all others, especially in the beginning when the farming was almost entirely extractive. Thus the Northwest grew spring wheat, the corn belt grew corn, and the South grew cotton more or less to the exclusion of other crops on the land well adapted to the most profitable crop in the respective regions.

In the process of changing the system of crop production so as to more nearly meet the requirements of a good rotation, the question of the proportions of the various crops to be included in the rotation is of first importance. Since corn is the most profitable crop in the corn belt section, it is evident that we should still continue to grow as much of this crop as is consistent with the maintenance of soil fertility, the advantageous distribution of man and horse labor, and crop insurance as provided by a reasonable amount of diversification. In actual practice it means that a good system of farming must include from 20 to 25 percent of the crop area in some legume crop each year. The proportion of legume acreage required will depend on the yield of the legumes grown, the nature of the other crops included in the rotation; the disposition made of the crops grown, either through livestock or direct sale, and the care with which the barnyard manures are handled and applied to the land.

All available data indicate that in the corn belt section corn should be grown on from 40 to 50 percent of the rotation area. When it is grown to a greater extent than this it becomes impracticable to maintain the soil fertility, the distribution of labor is very unsatisfactory, and insects and other pests cannot be so well controlled. If, therefore, we have from 40 to 50 percent of the rotation in corn, and 20 to 25 percent in legumes, we have remaining from 25 to 40 of the rotation area to grow other crops. Under corn belt conditions this usually means that the balance of the rotation should be made up of oats or a combination of wheat and oats in equal proportions where these two crops are about equally well adapted. Thus we would have the following as somewhat standard rotations for the corn belt sections of Illinois: (1) corn, corn, oats and legumes, or (2) corn, corn, oats, wheat and legumes.

Naturally these crops and the proportions will be varied with variations in the soils, topography, and climatic conditions. In the winter wheat- and rye-growing section of Illinois the rotation would include about the same proportion of wheat or rye as it does of corn in the corn belt section, the proportion of legumes would be in the main somewhat larger because of the poorer soils, leaving the balance of the rotation area to be devoted to next best crops which in this case might be corn, although corn is not particularly well adapted to most of the wheat-growing areas.

On the basis of all information available either from agronomic or farm management investigations as well as the experience of practical farmers, there seems to be after all little choice as to the range of crops which must be grown. The proportions of each crop, or the best combination of crops to be grown in the rotation seem to be also fairly well established for most of the important farming areas.

Once the general plan of the rotation is decided upon, a fairly good estimate of the average crop yields which should be produced under the system adopted can be made. Naturally there will be wide fluctuations in such crop yields, but the basis for estimating what they will be on the average is quite as definite as is the basis for making similar estimates for production in many other lines of industry.

On the basis of the number of crop acres and the nature of the rotation we can determine with considerable accuracy the number of work horses required to satisfactorily perform the work. The number of crop acres and the kind of crops grown will also furnish the basis for estimating quite accurately the machinery and tools required to operate the farm. By calculating the feed required by the work horses to be carried we can determine, by subtraction from the total feed produced, the amount of feed that will remain to be sold directly or converted into livestock and livestock products.

On the basis of this estimate of the amount of feed to be used for productive livestock, we must calculate as best we can how much livestock to plan for. Naturally the proportions and character of roughage and grains will determine to some extent the classes of stock we can best produce. If we have relatively more roughage and less grains we must plan on a larger proportion of cattle or sheep. If the section is a dairy section, dairy cows will naturally furnish a good market for the rough feeds in combination with some grain. In deciding this question the labor supply and the market for dairy products must naturally be taken into consideration.

If meat production is to be the chief business, we must decide whether we will grow our own beef calves or lambs, or whether we will buy all or a part of the feeder cattle or sheep. Nautrally the quality and finish to be put on the cattle will determine to some extent the proportion of roughage to grains needed. The better quality the cattle or sheep the more finish it will likely pay to put on them. The more finish desired the larger proportion of grain to rough feed will be required. Cheaper cattle, carried to a lower finish can use relatively larger proportions of roughage, such as silage and legume hay. Beef-breeding cows and breeding ewes can also use relatively large amounts of rough feeds. Naturally the supply of feeder animals, and the proportion of roughage and grain on hand must decide in a large measure the feeding system to be followed.

A certain balance must also be planned for between pork production and beef or mutton production. While we are learning to market relatively more rough feed, in the shape of green legumes, through hogs, the hog is after all mainly a means of marketing grain and concentrates, especially corn.

In working out the relative proportion of each class of productive livestock, we should make an attempt to determine the general ratios between grain and roughage for swine, beef cattle, and sheep according to the system planned, and from these ratios, and the feed on hand, work out as accurately as possible the proportions of each class of animals that can be fed.

In sections which normally produce a considerable surplus of feed, less attention need be paid to adjusting the animals carried, to the feed supply on the individual farm since feed can usually be purchased at a reasonable price. In sections which normally import feed the number of animals planned for should leave a margin of feed on hand, since in these sections especially when feed is scarce the price is usually too high to net much profit in feeding livestock. In general it is safer to plan on buying some feeding stock than to plan on buying feed. If feed is short none need be bought, if it is plentiful more stock can be purchased.

The feed requirements for producing the different kinds and amounts of meat products can be estimated in detail with a considerable degree of accuracy on the basis of the standard rations and the standard gains for each class and kind of meat animal. Thus we know that a certain amount of corn silage and legume hay should make a certain number of pounds of beef or mutton. Or a certain number of pounds of corn and tankage or a certain number of acres of legume forage will produce a certain number of pounds of pork.

The amount of feed produced, the number of horses carried, the machinery needed, and the kind and proportion of productive livestock will furnish the basis for planning with reasonable accuracy the building space required for storage, shelter and other purposes.

On the basis of the number of acres in the farm, the number of crop acres, and the amount and kind of livestock kept we can determine the number of men required to perform the labor necessary in carrying on the system of production as planned.

Thus we can work out on the basis of a considerable amount of accurate information available the most advantageous combination of crops to grow, *i.e.*, a good rotation for the region. We can calculate fairly accurately what should be the yields under good farming conditions. From the feed requirements of work horses and productive livestock we can determine fairly closely how much animal product of a given kind and quality can be produced under the system as planned. We can also determine quite accurately the buildings and machinery equipment needed and the man labor requirements of the system of farming as planned. That is, we can plan in advance with a considerable degree of accuracy the investments in the various classes of farm property, the amounts of crop material and animal product which the system will provide, and the general operating expenses, as well as the fixed charges of the business.

Naturally the results of any such system in terms of cash return cannot be guaranteed in advance. It seems logical to assume, however, that by carefully planning such a system we shall come much nearer realizing the results aimed at and more nearly insure a profit in the business. In fact definite progress has already been made by a considerable number of actual farmers in establishing carefully worked out plans of farm organization based on the general method of procedure outlined.

In spite of the fact that we already have in several of our most important farming regions a better basis for making plans for the somewhat scientific organizations of our farms than is commonly recognized, much remains still to be done. A great amount of carefully conducted investigational work needs still to be done to make possible really scientific procedure in the organization of our farms, if agriculture is to keep pace with the development of organization in other industries.